

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No. 0390112

Examiner Helene Myers

In re application:
PETER J. JESSUP ET AL.

PATENT

Serial No. 08/409,074
Filed: March 22, 1995

GASOLINE FUEL

Assistant Commissioner For Patents
Washington, D. C. 20231

Dear Sir:

AFFIDAVIT UNDER 37 CFR 1.132

I, Peter J. Jessup, being duly sworn, depose and say that:

1. I am by profession a Research Chemist, having earned the degree of Bachelor of Science in Chemistry in 1972 and the degree of Doctor of Philosophy in Chemistry in 1976, both from the Latrobe University, Melbourne, Australia;

2. I engaged in Post-Doctorate Research at the University of California at Irvine from 1976 to 1977 in the scientific field of natural product synthesis;

3. I have been employed by the Union Oil Company of California from 1978 to 1981 and, after being briefly employed with Exxon in 1981-1982, from 1982 to the present date. My current title is Principal Scientist and my professional responsibility is in the scientific field pertaining to research related to fuels, lubricant additives, fuel additives, synthetic chemistry, and fuel combustion chemistry, particularly as applied to diesel engines or internal combustion engines for motor vehicles;

4. I currently am the patentee or copatentee of 26 United States patents, most of which patents relate to automotive engines, fuels, and lubricants;

5. I am one of the applicants of the above-identified patent application, i.e., Serial No. 08/409,074 filed March 22, 1995 entitled "Gasoline Fuel," and all references hereinafter to "our patent application" and "our specification" are to said application and its specification, respectively.

6. Prior to the end of June 1990, Dr. Michael C. Croudace and I had run the experiment described in Example 1 of our patent application and had developed the equations pertaining thereto (See our specification on page 11.), which equations establish, among other things, that reducing the T50 of an unleaded gasoline would, all other things being equal, reduce both CO and HC tailpipe emissions when combusted in an automobile with a catalytic converter. (See our specification on page 11, line 28 to page 12, line 26.)

7. On July 17, 1990 I attended a meeting at Unocal's research facility in Brea, California at which Jonathan Haines, a representative from Toyota Technical Center, USA, Inc., distributed a two-page document (attached herewith as Attachment T1) showing data pertaining to fuels for a Toyota experiment. At present, I can no longer remember if Mr. Haines told me if the Toyota experiment relating to the 10 fuels shown in Attachment T1 was one which had been done by Toyota, was then currently being done by Toyota, or then still in the planning stage.

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10. Upon review of this Attachment T2, I found no evidence therein that decreasing T50 yields reductions in HC and CO emissions. Although the bar chart on page 7 of Attachment T2 allegedly relates T50 to the emissions produced from three fuels A, B, and C, the data in the document do not support this conclusion. According to the figure on said page 7, Fuel A yielded more HC and CO than Fuel B, which in turn yielded more than Fuel C. From this information, it appeared to me that Toyota had assumed that T50 was the cause of this phenomenon because, as shown on page 8 of Attachment T2, the T50 of fuel A was higher than Fuel B, which in turn was higher than the T50 of Fuel C. But the same could be said for density, and for IBP, and for T10, and for aromatics, and for octane. Any one, or some combination thereof, or some other gasoline property or properties, or yet other factors, could have been responsible for the emissions results of Fuels A, B, and C.

11. In sum, I found Toyota's apparent reasoning for concluding that decreasing T50 decreases HC and CO emissions to be seriously flawed and scientifically invalid, the conclusion being unsupported from the data and other information on pages 7 and 8. Essentially, from the information presented on pages 7 and 8 of Attachment T2, what Toyota did was prepare three fuels of widely varying properties and then, for unknown reasons, arbitrarily ascribe the emission results as a function of one of the properties.

12. Thus, while Toyota's conclusion that decreasing T50 decreases HC and CO emissions agreed with my own earlier finding, I could not, and did not, accept the work reflected in Attachment T2 as confirmation of my earlier finding.

FURTHER AFFIANT SAYS NOT.

Peter J. Jessup
Peter J. Jessup

Subscribed and sworn to me this 10th day of July, 1995.

Pat Lance
Pat Lance
Notary public for and in
State of California
County of Orange
My Commission Expires FEBRUARY 1, 1997



0814091074. (Claim number)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	8010	8011	8012	8013	8014	8015	8016	8017	8018	8019	8020	8021	8022	8023	8024	8025	8026	8027	8028	8029	8030	8031	8032	8033	8034	8035	8036	8037	8038	8039	8040	8041	8042	8043	8044	8045	8046	8047	8048	8049	8050	8051	8052	8053	8054	8055	8056	8057	8058	8059	8060	8061	8062	8063	8064	8065	8066	8067	8068	8069	8070	8071	8072	8073	8074	8075	8076	8077	8078	8079	8080	8081	8082	8083	8084	8085	8086	8087	8088	8089	8090	8091	8092	8093	8094	8095	8096	8097	8098	8099	80100	80101	80102	80103	80104	80105	80106	80107	80108	80109	80110	80111	80112	80113	80114	80115	80116	80117	80118	80119	80120	80121	80122	80123	80124	80125	80126	80127	80128	80129	80130	80131	80132	80133	80134	80135	80136	80137	80138	80139	80140	80141	80142	80143	80144	80145	80146	80147	80148	80149	80150	80151	80152	80153	80154	80155	80156	80157	80158	80159	80160	80161	80162	80163	80164	80165	80166	80167	80168	80169	80170	80171	80172	80173	80174	80175	80176	80177	80178	80179	80180	80181	80182	80183	80184	80185	80186	80187	80188	80189	80190	80191	80192	80193	80194	80195	80196	80197	80198	80199	80200	80201	80202	80203	80204	80205	80206	80207	80208	80209	80210	80211	80212	80213	80214	80215	80216	80217	80218	80219	80220	80221	80222	80223	80224	80225	80226	80227	80228	80229	80230	80231	80232	80233	80234	80235	80236	80237	80238	80239	80240	80241	80242	80243	80244	80245	80246	80247	80248	80249	80250	80251	80252	80253	80254	80255	80256	80257	80258	80259	80260	80261	80262	80263	80264	80265	80266	80267	80268	80269	80270	80271	80272	80273	80274	80275	80276	80277	80278	80279	80280	80281	80282	80283	80284	80285	80286	80287	80288	80289	80290	80291	80292	80293	80294	80295	80296	80297	80298	80299	80300	80301	80302	80303	80304	80305	80306	80307	80308	80309	80310	80311	80312	80313	80314	80315	80316	80317	80318	80319	80320	80321	80322	80323	80324	80325	80326	80327	80328	80329	80330	80331	80332	80333	80334	80335	80336	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Pressure Conversions

Enter the pressure in any of the following units:
bar, dbar, mbar, Pascal, hPa, kPa, psi, at., mmHg, inHg, Torr, kg/cm², kg/m².
Or press the Enter key for one atmosphere <e.g. 5kPa>... 1 kg/cm²

The Pressure conversions for 1 kg/cm² are:

9.80661E-01	9.80661E+00	9.80661E+01	9.80661E+02	9.80661E+04	
bar	decibar	kPa	millibar(hPa)	Pascal(N/m ²)	
1.0000E+00	1.0000E+04	7.3556E+02	2.8959E+01	1.4223E+01	9.6784E-01
kg/cm ²	kg/m ²	mmHg (Torr)	inch Hg	psi	atmospheres
9.8066E+05	9.8066E+05	1.0000E+03	3.2808E+01	1.0241E+00	9.8066E+00
barye	dyne/cm ²	cmH2O	ft H2O	ton/ft ²	N/cm ²

Enter another pressure to convert (or just press Enter to finish) ...
<e.g. 5kPa>...

The Pressure conversions for 700 mbar are:

7.00000E-01	7.00000E+00	7.00000E+01	7.00000E+02	7.00000E+04	
bar	decibar	kPa	millibar(hPa)	Pascal(N/m ²)	
7.1380E-01	7.1380E+03	5.2504E+02	2.0671E+01	1.0153E+01	6.9085E-01
kg/cm ²	kg/m ²	mmHg (Torr)	inch Hg	psi	atmospheres
7.0000E+05	7.0000E+05	7.1380E+02	2.3419E+01	7.3099E-01	7.0000E+00
barye	dyne/cm ²	cmH2O	ft H2O	ton/ft ²	N/cm ²

Enter another pressure to convert (or just press Enter to finish) ...
<e.g. 5kPa>...

①: Witzbicki

4-28-94
NOMERITS

- Amendment
- can be used, stand w/o IDS

? 1-2

Clm 83 compensation RICO est
fuel

106 -

X VOL 6 volumes
TAB MOST Pertinent

TAB Blue less pertinent

CRC Papers - numerical
chronological

PATENTS

→ Red file copies things IDS
Statement - Duplicates

GASOLINE

PUBLICATION NO: 05-179263

LAID-OPEN DATE: JUL. 20, 1993

INVENTOR: TAKASHI KANEKO, et al. (1)
ASSIGNEE: NIPPON OIL CO LTD, et al. (40)
APPL NO: 03-358562
DATE FILED: Dec. 27, 1991

INFO RE PUBLICATION IN PERIODICAL Patent Abstracts of Japan

GROUP NO: C1126
VOLUME: Vol. 17, No. 594
DATE: Oct. 29, 1993

INTERNATIONAL CLASSIFICATION: C10L 1*18; C10L 1*04; C10L 1*16

ABSTRACT:

PURPOSE: To obtain the subject gasoline excellent in the accelerating ability at low temperatures and warming up and low in the amount of exhaust NO_x by blending a prescribed amount of methyl-t-butyl ether and light naphtha with a base gasoline having specified distillation properties and a composition.

CONSTITUTION: The objective gasoline containing olefin components and aromatic components respectively in a low amount is obtained by blending (A) a base gasoline having distillation properties specified by formulae I and II [T₃₀(BASE), T₇₀(BASE) and T₉₀(BASE) are respectively 30% distillation temperature, 70% distillation temperature and 90% distillation temperature of the base gasoline] and a composition specified by formulae III, IV and V [VO(BASE) and VA(BASE) are respectively content of olefin components and content of aromatic components] with (B) 3 to 20vol% methyl-t-butyl ether and (C) light naphtha in an amount satisfying formula VI (VM is content of methyl-t-butyl ether and VL is content of light naphtha).

RECEIVED
94 APR 28 PM 2:30
GROUP: 110

10/26/90

TOYOTA

Memo from

Peter,

Here is more information to follow-up on our discussions a few weeks ago. When we receive more data, I'll keep you informed.

Jonathan

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Peter J. Jessup
Peter J. Jessup

Subscribed and sworn to me this 10th day of July, 1995.

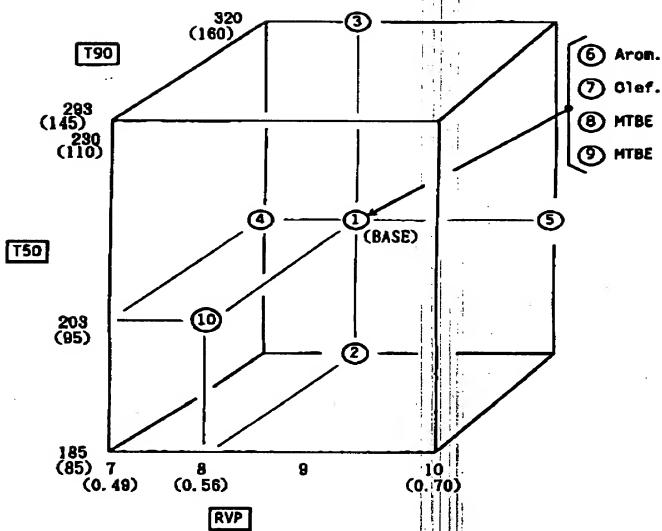
Pat Lance

Notary public for and in
State of California
County of Orange
My Commission Expires FEBRUARY 1, 1997



$T_{50} \uparrow \equiv \text{emissions } \uparrow$

From Toyota
7-17-90



Test Gasoline Matrix

TEST FUELS FOR REFORMULATED GASOLINE STUDY - target specs.

Fuel No.	RON (MON)	RVP psi	T50 °F	Arom. vol. %	Olef. vol. %	MTBE vol. %	Comments
1	97	87	8.0 (0.36)	203 (95)	30 (160)	12	0 Base Case
2	97	87	8.0	185 (85)	30	12	T50 Reduction
3	97	87	8.0	239 (110)	30	12	T50 Increase
4	97	87	7.0 (0.39)	203	30	12	RVP Reduction
5	97	87	10.0 (0.70)	203	30	12	RVP Increase
6	97	87	8.0	203	15	12	Arom. Contents Reduction
7	97	87	8.0	203	30	0	Olef. Contents Reduction
8	97	87	8.0	203	30	12	MTBE Blend (Medium Conc.)
9	97	87	8.0	203	30	12	MTBE Blend (Maximum Conc.)
10	97	87	8.0	203 (145)	30	12	T50 Reduction

X = variables
 AKI = 92
 drivability
 FTP emissions

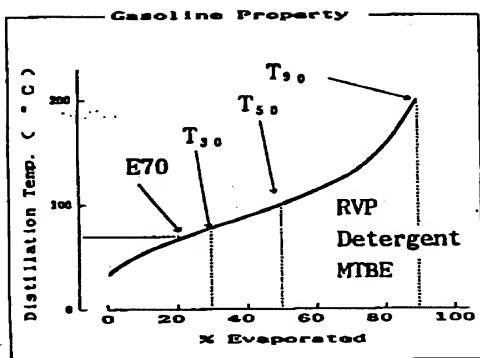
Toyota wants tight control
 of T50 in reformulated
 gasolines.

T50 85→100 °C
 pushing @ CARB

Same 50% change in
 emissions by changing T50

EFFECT OF GASOLINE PROPERTY ON EXHAUST EMISSIONS AND DRIVEABILITY

TOYOTA MOTOR CORPORATION
OCTOBER, 1990



- Exhaust Emissions
- Driveability (during Warm-up)

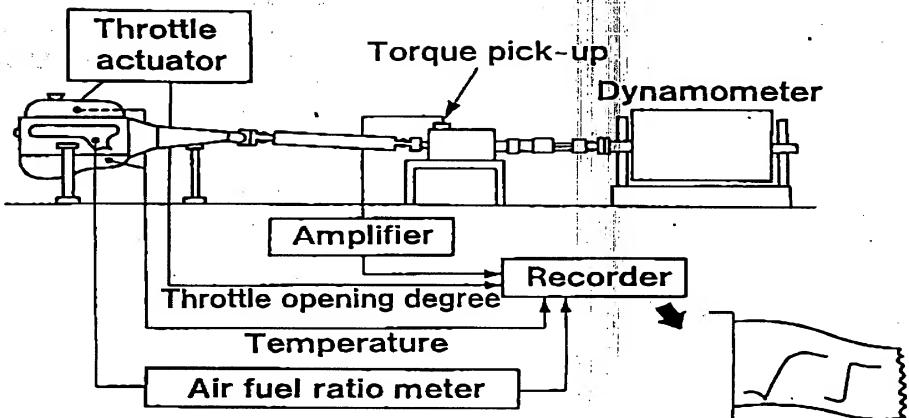
1. Driveability Test

- * Hesitation during Warm-up Period
 - Engine Bench Test
 - Engine Response Time
 - Vehicle Test --- Field Evaluation
- * Engine Startability Test
 - Low Temperature Test Cell --- 20° C, -25° C

2. Exhaust Emission Test

Tailpipe Emissions, FTP

Study of the Effect
of
Gasoline Property
on
Engine Response



TOYOTA

Experimental apparatus

No. 5

Gasoline No.	1	2	3	---	10	11	12
RVP kPa	71.5	65.7	71.5	---	83.3	84.8	46.0
E70 %	32.3	27.8	32.9	---	33.4	35.7	20.5
T10 °C	48.0	50.5	47.0	---	42.0	41.0	59.5
T50 °C	91.5	99.0	91.0	---	100.0	94.0	110.0
T90 °C	152.0	159.0	152.0	---	162.5	163.0	161.0
Arom. %	28.5	28.0	38.5	---	47.0	38.0	32.8

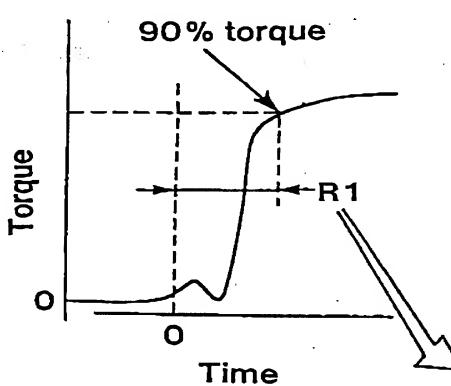
(no oxygenate)

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Test gasolines

(page 3)

No. 8

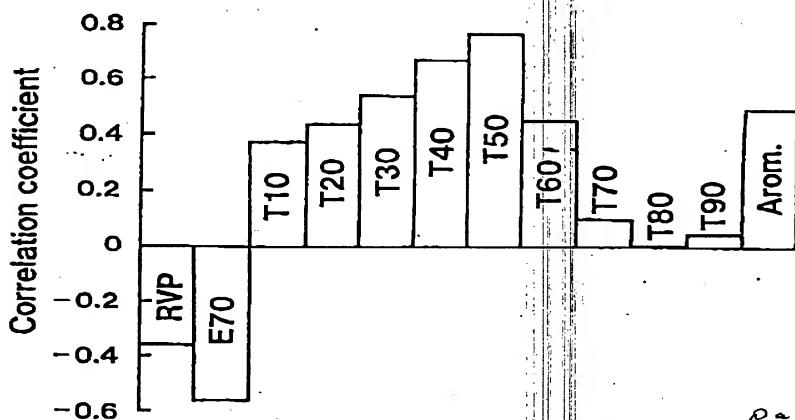


Gasoline	1	2
RVP, kPa	71.5	65.7
E 70, %	32.3	27.8
T 10, °C	48.0	50.5
T 50, °C	91.5	99.0
T 90, °C	152.0	159.0
Arom. %	28.5	28.0
Response time (sec.)	R1	R2

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Response time and gasoline characteristics

No. 9

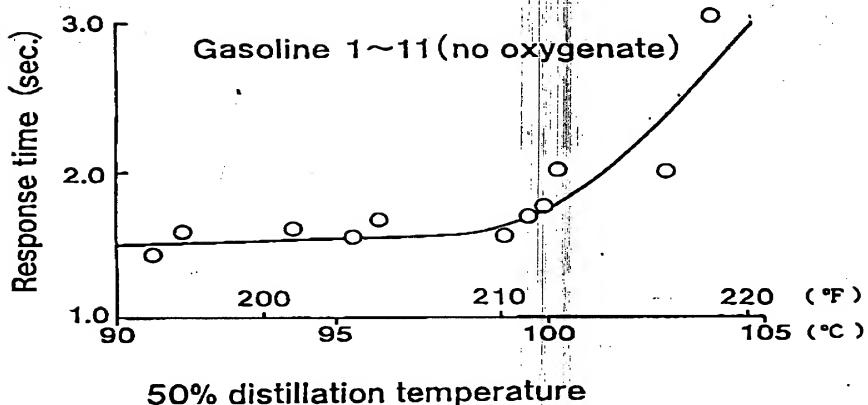


Page 4

TOYOTA

Comparison of correlation

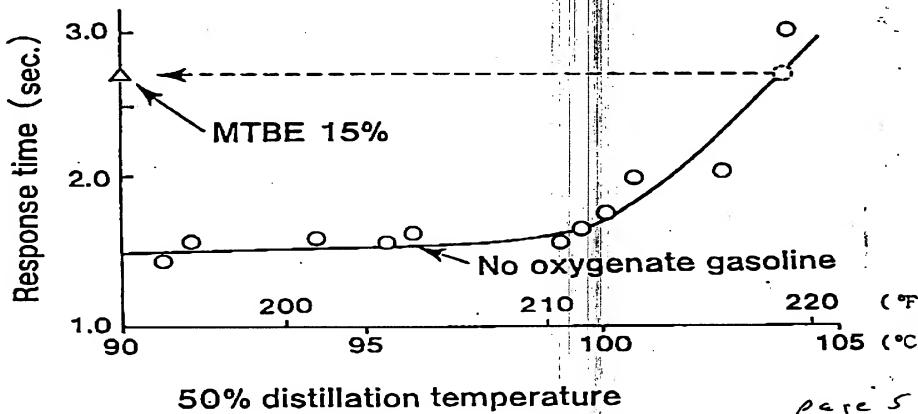
No. 10



TOYOTA

Effect of 50% distillation temperature

No. 11

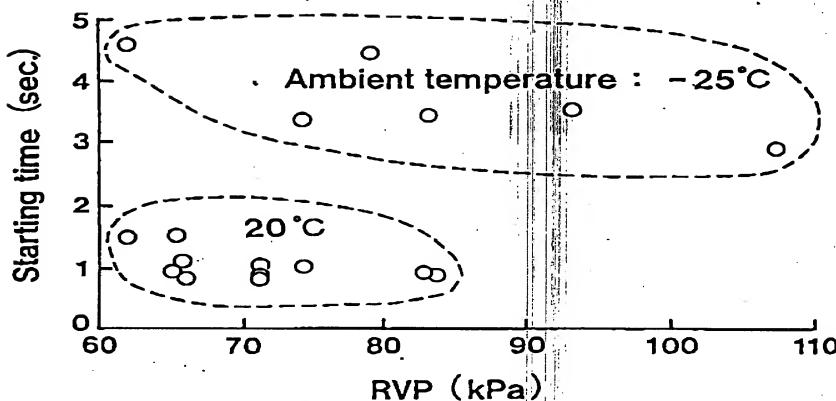


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Effect of MTBE blended gasoline

No. 20

page 5



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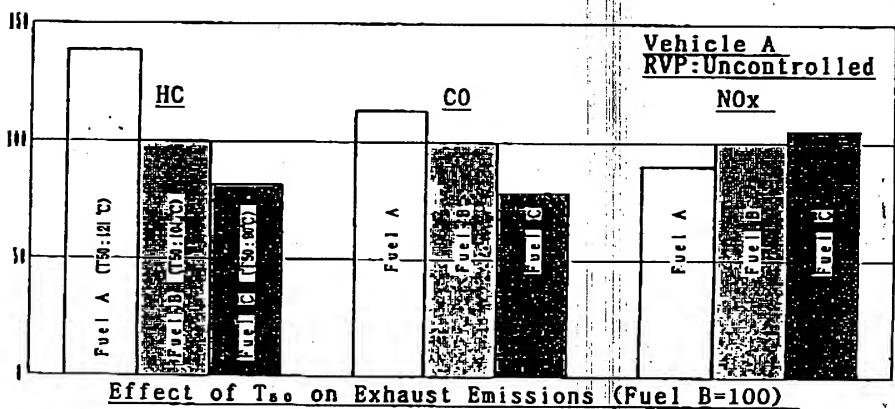
Effect of RVP on engine start

No. 14

Results of Driveability Test

1. The Middle Range of Gasoline Distillation Temperature Strongly Affects Warm-up Driveability.
 T_{50} Can Be Used as One Indication of Warm-up Driveability.
2. RVP Has a Small Effect on Warm-up Driveability in the Range between 60~90 KPa (8.6~13.0 psi).
3. RVP Regulation Will not Deteriorate Vehicle Driveability, if T_{50} is controlled in a proper range.

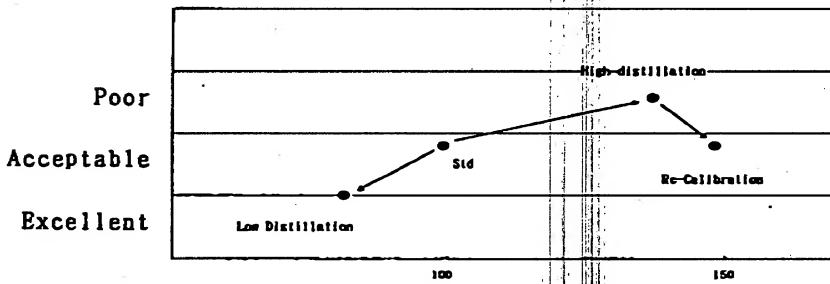
Study of the Effect
of
Distillation Characteristics
on
Exhaust Emissions



Comparison of Fuel Characteristics (A)

Fuel Characteristics	Fuel A	Fuel B	Fuel C
Density(g/ml@15°C)	0.766	0.743	0.734
RVP (kgf/cm ³)	0.55	0.62	0.845
RON	97.2	91.5	91.4
MON	88.4	82.5	82.3
Distillation (°C)	I B P	34.5	31.5
	10%	58.5	53.0
	50%	121	104
	90%	170	157
	E P	209	176
	Aromatics (vol%)	39.3	31.8
Olefins (vol%)	9.0	5.1	14.5

Driveability

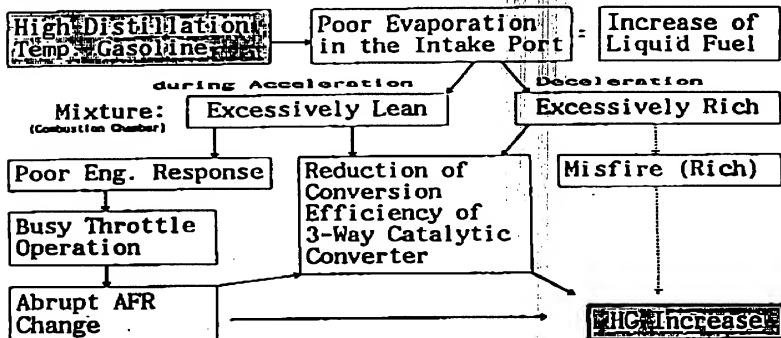


HC Emission

Effect of Gasoline Distillation Characteristics on
Exhaust Emission and Driveability

Page 8

MECHANISM OF HC INCREASE WITH HIGH T_{50} GASOLINE



Result of TOYOTA's Study

Low T_{50} Gasoline

Better Driveability

Leaner Engine Calibration

Reduction of HC and CO Emissions

US Oil Industry's Insistence

RVP Regulation

Low RVP

without Refinery Modification

Low Octane Number

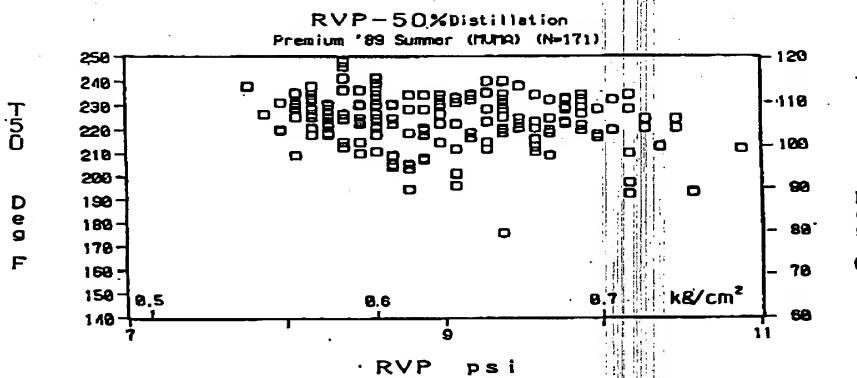
Octane Number Readjusting

Higher T_{50}

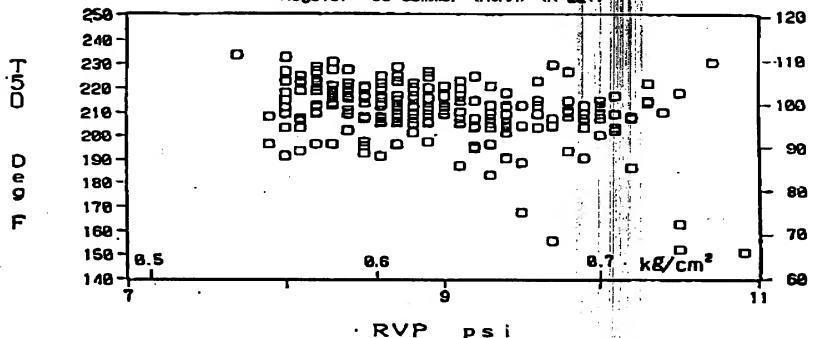
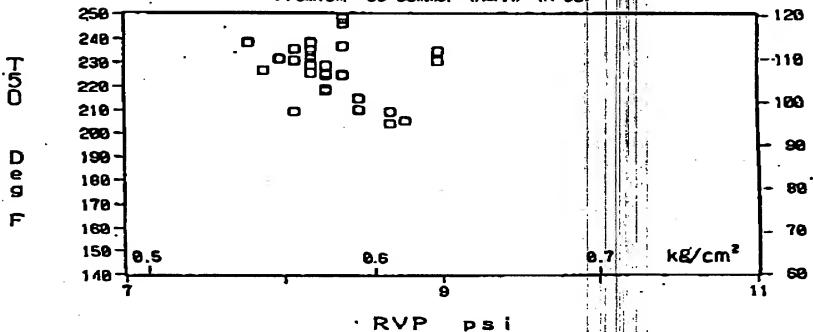
Distillation Temperature (T_{50}) in the US Market should be better controlled as well as RVP

Possible Increase of HC Emission

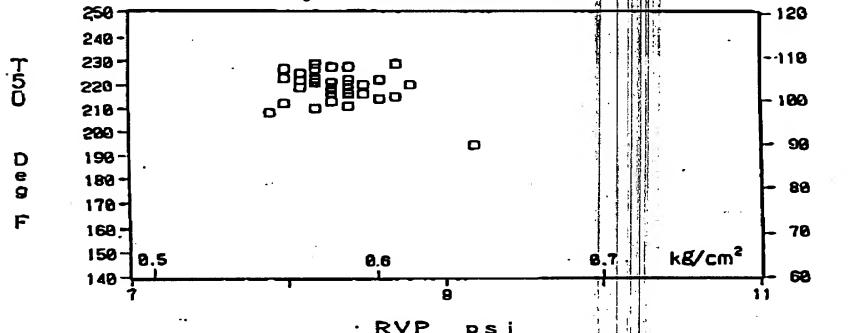
Distribution
of
Gasoline Characteristics
in
the US Market



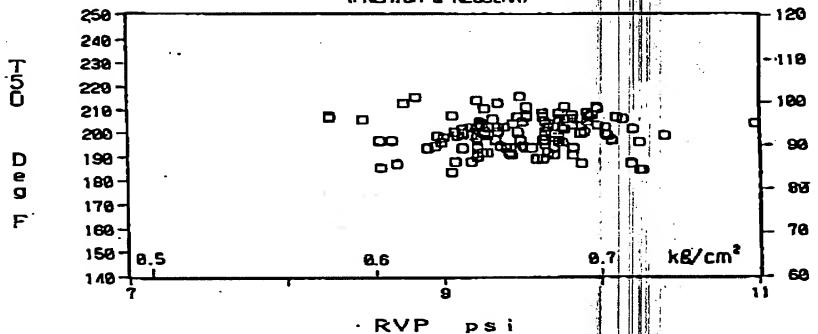
page 10

RVP - 50% Distillation
Regular '89 Summer (MMA) (N=227)RVP - 50% Distillation (WEST)
Premium '89 Summer (MMA) (N=38)

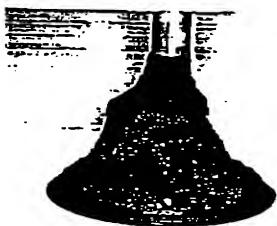
RVP - 50% Distillation (WEST)
Regular '89 Summer (MUTA) (N=38)



JAPAN '89 Summer (N=131)
(PREMIUM & REGULAR)



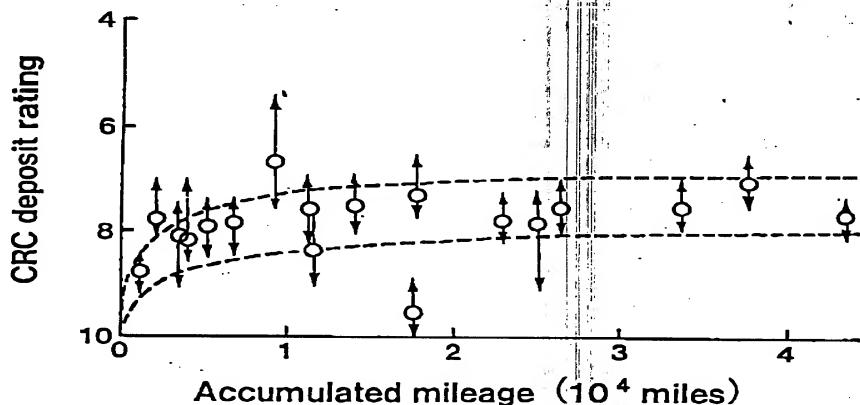
Study of the Effect
of
Intake Valve Deposit (IVD)
on
Exhaust Emissions and Driveability



Test I



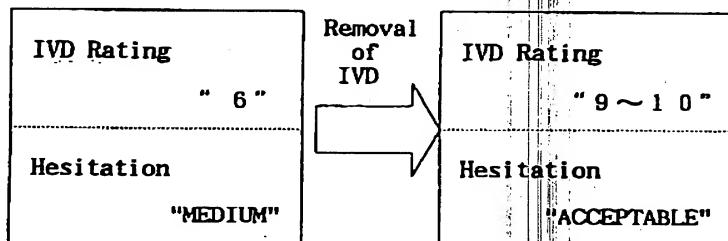
Test II



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IVD level in the US market

No. 26

Effect of IVD on Vehicle Driveability

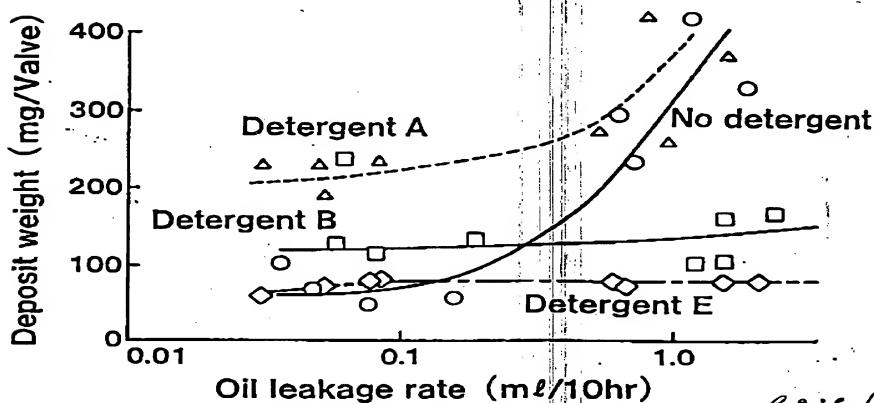
Page 14

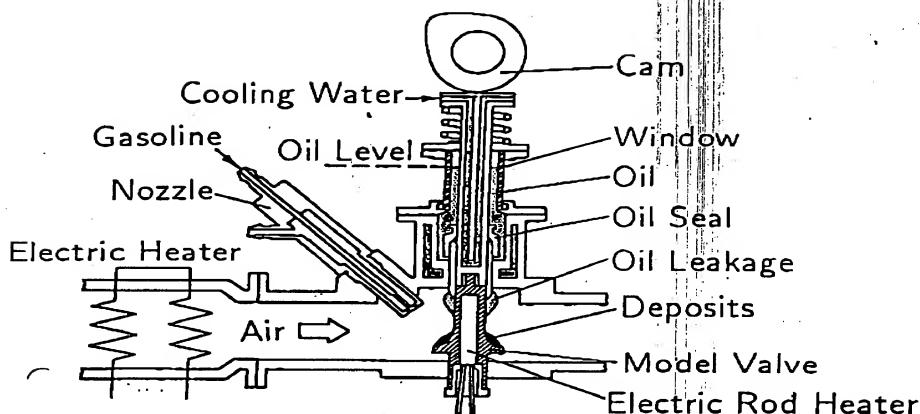
IVD Rating " 6 "

HC	1 4 9
CO	1 0 1
NO _x	1 2 7

IVD Rating " 9 ~ 1 0 "

HC	1 0 0
CO	1 0 0
NO _x	1 0 0

Removal
of
IVDEffect of IVD on Exhaust Emissions

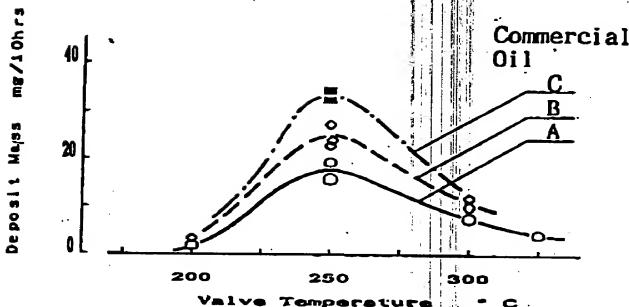


TOYOTA
C. R&D, INC.

Structure of Simulator

Results of Our Study on the Intake Valve Deposit

- (1) IVD Mainly Originates from Engine Oil.
- (2) Poor Quality Gasoline Detergents Accelerate Oil Deterioration, and This Increases IVD Formation.
- (3) Oil Quality Affects IVD Formation.
(See Next Slide)



Effect of Oil Quality on Intake Valve Deposit

CONCLUSION

- (1) The middle Range of Gasoline Distillation Temperature affects Warm-up Driveability, and HC and CO Emissions.
- (2) A T_{50} Decrease of 10- 15° C Produces 15-25 % Reduction of HC and CO Emissions.
- (3) RVP Regulation may Encourage High T_{50} Gasoline in the US Market and result in Increased HC and CO Emissions, IF the Distillation Temperatures Are Not Controlled.
- (4) It Is Hoped the Range of T_{50} Distribution in the US Will Be Reduced. This Will Contribute to Improved Air Quality.
- (5) MTBE-Blended Gasoline Shows Poor Engine Response Characteristics Compared with HC-Type Gasolines.
- (6) IVD Deteriorates HC and CO Emissions. Engine Oil and Fuel Detergent Quality also Affect IVD.

Survey of Driveability

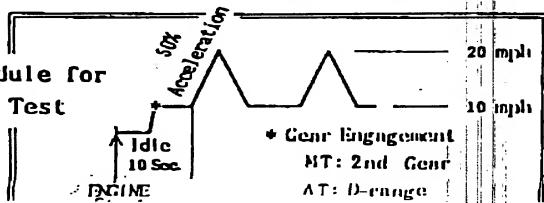
of

USA Cars

Test Vehicle

Model	Year	Engine	Displace- ment (l)	Fuel System	Trans- mission	Mileage
T ₁	'87	L 4	2.0	FI	M T	1130
T ₂	'89	L 6	3.0	FI	A T	3440
A	'87	V 6	3.8	FI	A T	898
B	'88	L 4	2.3	FI	A T	2830
C	'88	L 4	2.2	FI	M T	869
D	'88	V 6	2.7	FI	M T	3230

Driving Schedule for Driveability Test



Vehicle Model	Gasoline Water * T50 (C) Temp (C)	Test Cycle No.					Comment
		2	3	4	5		
T1	102	9					
	109	7					
T1	119	9					Back Fire
	119	30					Back Fire
A	119	7					
B	109	17					Smoke
	102	5					
C	109	5					Back Fire
	119	30					
D	119	9					Engine Stall
	119	1					Back Fire
D	119	5					
	119	18					

* Water Temperature at Engine Start

Hesitation



Driveability Test Results

Summary of the Driveability Test

* We believe Customers in the USA Suffer Poor Driveability :

- Caused by High Distillation Gasoline
- Deteriorated by IVD Formation during warm-up Period
- Particularly in the West Coast Area

10/29/80

TOYOTA

Memo from

Peter,

Here is more information to follow-up on our discussions a few weeks ago. When we receive more data, I'll keep you informed.

Jonathan